

when the duration of cloudiness is alone desired, as is usually the case.

The cloudiness is determined by numerous personal observations at all stations during the daytime, and is given in the column of "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

#### COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *duration* of direct sunshine whence the percentage of duration of possible sunshine is derived; the observer's personal estimates give the percentage of *area* of clear sky. These numbers have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental record of percentages of duration of sunshine is almost always larger than the observers' personal estimate of percentages of area of clear sky; the average excess for November, 1895, is 4 per cent for photographic records, and 6 per cent for thermometric records. The details are shown in the following table:

##### *Difference between instrumental and personal observations of sunshine.*

Photographic stations.				Thermometric stations.			
	Instrumental.	Personal.	Difference.		Instrumental.	Personal.	Difference.
Phoenix, Ariz.....	81	70	11	San Francisco, Cal.....	66	63	3
San Diego, Cal.....	78	70	8	Atlanta, Ga.....	64	58	6
Santa Fe, N. Mex.....	70	65	5	Vicksburg, Miss.....	56	55	1
Dodge City, Kans.....	69	64	5	New Orleans, La.....	57	56	1
Denver, Colo.....	68	58	10	Little Rock, Ark.....	54	43	11
Eureka, Cal.....	63	58	5	Philadelphia, Pa.....	53	43	10
Savannah, Ga.....	52	50	2	Detroit, Mich.....	51	40	11
Salt Lake City, Utah.....	50	34	16	St. Louis, Mo.....	51	35	16
Galveston, Tex.....	48	46	2	Wilmington, N. C.....	50	48	2
Washington, D. C.....	46	52	-6	New York, N. Y.....	49	44	5
Kansas City, Mo.....	45	44	1	Portland, Me.....	48	38	10
Helena, Mont.....	38	34	4	Baltimore, Md.....	45	49	-4
Eastport, Me.....	37	20	17	Columbus, Ohio.....	45	31	14
Portland, Oreg. †.....	31	34	-3	Des Moines, Iowa.....	45	32	13
Cleveland, Ohio.....	28	32	-4	Rochester, N. Y.....	45	36	9
Bismarck, N. Dak.....	19	31	-12	Chicago, Ill.....	41	31	10
				Cincinnati, Ohio.....	41	37	4
				Boston, Mass.....	37	34	3
				Louisville, Ky.....	34	30	4
				Buffalo, N. Y.....	33	26	7
				Portland, Oreg. †.....	29	34	-5
				Marquette, Mich.....			

\* No thermometric report.

† Records kept by both methods.

#### WIND.

The *prevailing winds* for November, 1895, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart II, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

The *diurnal variation* in the velocity of the wind is shown in Table VI, which gives the total movement for each hour of seventy-fifth meridian time, as deduced from self-registering anemometers at about 136 stations.

#### HIGH WINDS.

*Maximum wind velocities* of 50 miles or more per hour were reported at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		<i>Miles</i>				<i>Miles</i>	
Block Island, R. I.....	13	54	ne.	Hatteras, N. C.....	13	53	n.
Do.....	13	50	ne.	Independence, Cal.....	21	50	n.
Buffalo, N. Y.....	26	68	w.	Kittyhawk, N. C.....	13	54	n.
Chicago, Ill.....	27	53	s.	Do.....	13	59	n.
Cleveland, Ohio.....	26	73	s.	Do.....	13	54	n.
Detroit, Mich.....	26	78	sw.	Lexington, Ky.....	25	62	s.
El Paso, Tex.....	3	50	sw.	Louisville, Ky.....	25	50	sw.
Erie, Pa.....	26	54	sw.	Do.....	25	57	sw.
Fort Canby, Wash.....	13	72	se.	Port Huron, Mich.....	26	55	sw.
Do.....	26	62	se.	Toledo, Ohio.....	26	60	sw.
Do.....	28	78	se.	Woods Holl, Mass.....	1	50	se.
Do.....	29	60	s.	Do.....	21	52	sw.
Hatteras, N. C.....	12	54	n.				

#### ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table X, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

The dates on which reports of thunderstorms for the whole area were most numerous, were: 5th, 29; 25th, 22; 26th, 29.

Thunderstorm reports were most numerous in: Florida, 17; Massachusetts, 15; New Jersey, 24.

Thunderstorms were most frequent in: Florida, 8; Arizona and Texas, 6; Arkansas, Georgia and Oregon, 5.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 1st to the 5th, inclusive, and also the 27th to 30th. On the remaining twenty-one days of this month 333 reports were received, or an average of about 16 per day. The dates on which the number of reports especially exceeded this average were: 9th, 142; 10th, 63; 11th, 39; 12th, 21; 23d, 28.

The ratio of the number of reports to the number of observers was largest in: Illinois, 29 per cent; Minnesota, 75; North Dakota, 80; South Dakota, 43; Wisconsin, 67.

Auroras were reported most frequently in: Minnesota, Montana and Wisconsin on nine days; Massachusetts and New York, eight; Illinois, North and South Dakota, seven.

The most important display of the month was that of the 9th, 10th, 11th, and 12th. Many observers remark on this as being one of the brightest auroras on their records.

#### CANADIAN DATA—THUNDERSTORMS AND AURORAS.

The only thunderstorm reported was on the 9th at Montreal.

The dates of auroras were as follows: Sydney, 11; Grand Manan, 12; Father Point, 13, 24; Quebec, 24; White River, 9; Saugeen, 12; Port Arthur, 9 to 12; Winnipeg, 9; Minnedosa, 10 to 15, 21, 23, 24; Qu'Appelle, 9; Medicine Hat, 11, 22; Swift Current, 23; Prince Albert, 22, 23, 25, 26; Edmonton, 11.

#### INLAND NAVIGATION.

The *extreme and average stages of water* in the rivers during the current month are given in Table VII, from which it will be seen that no river attained the danger point and that on the average the waters continued quite low, as in October. At Vicksburg the Mississippi declined steadily until the 14th, when it was 6.3 feet below the low water mark adopted as the zero of the gauge. At Memphis, Helena, Arkansas City, Greenville, and Vicksburg the mean stage of water for the month was from 2.0 to 5.7 feet below the zeros of the respective gauges. During the latter part of the month the Ohio River and its tributaries generally rose a few feet.

## ICE IN RIVERS AND HARBORS.

The following reports of ice in connection with navigation have been received:

*Williston, N. Dak.*—8th, the Missouri River frozen over at this place and at Fort Buford.

*St. Vincent, Minn.*—6th, the Red River of the North frozen over and foot passengers crossing on the ice.

*St. Paul, Minn.*—26th, the Mississippi River frozen and navigation closed.

*Sioux City, Iowa.*—21st, a small amount of running ice in Missouri River; 22d, much running ice in river; 23d, river channel full of running ice.

*Omaha, Nebr.*—25th, large quantities of floating ice running in the Missouri.

*Davenport, Iowa.*—24th, small quantities of floating ice in the Mississippi near shore; 26th, river full of floating ice.

## METEOROLOGY AND MAGNETISM.

By PROF. FRANK H. BIGELOW.

For general remarks relative to this subject see page 7 of

the REVIEW for January, 1895, and page 371 of the REVIEW for October, 1895.

The comparison of the air temperature with magnetic horizontal force is shown in detail on Chart V, and the special features of the November curves are as follows:

A comparison of the curves of vertical force for Washington and Toronto shows that, in order to minimize the deflections caused by the passing trolleys, the magnetic balance at Washington is damped very much more than that at Toronto. In order to bring these deflections approximately to the same amplitude the following method has been adopted: Each station is computed separately to obtain the values of  $d_z$  or the deflections in the vertical force; then the values for Washington are multiplied by the factor 2, and those for Toronto by the factor  $\frac{1}{2}$ ; finally, the means are taken, which appear as  $d_z$  in the table of Chart V.

## CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts in regard to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

*Alabama.*—The month was dry, with marked thermal changes, and unusually cool. The mean temperature was slightly above the normal. The highest temperature, 84°, was recorded at Ashville on the 7th, and the lowest, 18°, at Decatur and Newburg on the 27th. The average precipitation was 1.64, or 2.20 less than normal; the greatest amount, 3.60, occurred at Cordova, and the least, 0.46, at Livingston. Owing to the prolonged deficiency in moisture nearly all rivers were so low that navigation was nearly suspended. Thick ice formed in various sections on the 27th. Frosts were reported on all dates, except 6th to 9th, 15th, 19th, 23d to 25th, and 29th.

*Arizona.*—The mean temperature was 51.8°, or about 3° below the normal. The highest temperature, 91°, occurred at Mohave on the 1st, and Parker on the 19th, and the lowest, 8° below zero, at Holbrook on the 26th. Rains were general throughout the Territory from the 2d to 4th, 11th, 12th, and from 22d to 24th, inclusive. The average total amount, 2.70, was 1.85 in excess of the normal. The greatest monthly rainfall was 6.83 at Oracle, and the least, 0.01, at Texas Hill. Frosts occurred on the 1st to 14th, and from the 23d to 28th; hail on the 11th and 14th, and snow on the 2d, 3d, 4th, 12th, 22d, 23d, 24th, and 25th; the largest amount was 0.36 at Show Low.

*Arkansas.*—The mean temperature was 49.9°, or 0.08° below the normal. The highest temperature, 82°, was recorded at Bee Branch on the 18th, and lowest, 16°, at Winslow on the 25th, and Keesees Ferry on the 27th. The average precipitation, 4.87, was 0.23 less than the usual amount. The greatest monthly amount, 7.68, occurred at Osceola, and the least, 2.75, at Fulton. There was sufficient moisture for all agricultural needs, but the rivers were low during the greater part of the month, making navigation of the Arkansas extremely difficult.

*California.*—The mean temperature was 52.8°, or 0.6° below the normal. The highest temperature, 98°, was recorded at Salton on the 19th, and the lowest, 1° below zero, at Bodie on the 30th. The average precipitation was 1.43, or 1.00 less than normal. The greatest monthly amount, 5.34, occurred at Fort Ross, and the least, 0.00, at Pasadena, Ravenna, and Volcano Springs. Snow to the depth of from "trace" to 28 inches was reported from some of the mountain stations. Frosts occurred at one or more stations every day.

*Colorado.*—The mean temperature was about normal over Mesa and Montrose counties, but in other sections the month was cooler than usual; the deficiency averaged about 2° per day over the eastern Slope, 4° in the San Luis Valley, and 5° over the northwestern counties. The highest temperature was 80° at Crook on the 2d, and at Minneapolis on the 2d and 21st, and the lowest, 35° below zero, at San Juan (near) on the 25th. In the central mountain districts only half of the usual amount of precipitation occurred, while over the western valleys from 2 to 5 times the average amount was recorded. East of the mountains there were no marked departures from the normal. The greatest amount was 10.73 at Ruby, and the least, 0.06, at Julesburg. The depth of snow on the ground at the end of the month (as well as the area covered on the western side) was much greater than at the same date last year, Ruby having a depth of 5 feet.

*Connecticut.*—(See *New England*.)

*Delaware.*—(See *Maryland*.)

*Florida.*—The mean temperature was 66°, or about normal. The highest temperature was 90° at Orlando on the 10th, and the lowest, 30°, at Tallahassee, on the 27th. The average amount of precipitation, 2.71, was about 0.23 in excess of the normal. The greatest monthly amount, 5.53, occurred at St. Augustine, and the least, 0.24, at Key West. Frosts occurred on the 13th, 14th, 16th, 18th, 20th, 21st, 22d, and 27th.

*Georgia.*—The mean temperature was 54.6°, or about 1° above the normal. The highest temperature was 89° at Brunswick on the 9th, and the lowest, 19°, at Clayton on the 21st. The average precipitation was 1.75, or 1.35 less than the usual amount. The greatest monthly was 3.74 at Savannah, and the least, 0.73, at Fort Gaines. Although November is one of the driest months, it was this year even drier than usual. Frosts were general in the northern and central counties, and in exposed localities in the most northerly portions of the southern counties during the period from the 11th to 13th, when the first killing frosts of the season were recorded at many places.

*Idaho.*—The mean temperature was 33.1°, or about 7° below that for November of last year. The highest temperature was 72° at St. Anthony on the 28th, and the lowest, 17° below zero, at Warren on the 22d. The average amount of precipitation was 1.08; the greatest amount for the month, 2.91, at Murray, and the least, 0.15, at Payette.

*Illinois.*—The mean temperature was 39.2°, or but a fraction of a degree above the normal. The highest temperature was 79° at Carlinville on the 7th, but elsewhere the highest generally occurred on the 4th; the lowest temperature, 6° below zero, occurred at Winnebago on the 21st. The average precipitation was 3.85, or about 0.75 in excess of the usual amount. The greatest amount, 7.37, was recorded at Iron, and the least, 1.62, at Scales Mound. Snowfall was practically confined to the central and northern counties; that in the northeast counties being very heavy. The average depth for the State was above 6 inches.

*Indiana.*—The mean temperature was 41.1°, or but 0.4 above the normal. The highest temperature was 78° at Madison on the 6th, and the lowest, 6°, at Valparaiso on the 26th. Excessive rains fell everywhere on many days. The average precipitation was 5.51, or 1.71 in excess of the usual amount. The greatest monthly amount was 12.98, at Marengo, and the least, 2.55, at Valparaiso. Snow on the 9th, 16th, 20th, 21st, 24th, 25th, 26th, and 30th. The greatest amount of snow fell in the northern counties, where a depth of 15 inches was recorded. Stock-water in wells, springs, and streams was increased and navigation on the Ohio River resumed. Lightning occurred on the 7th.

*Indian Territory.* (See *Oklahoma*.)

*Iowa.*—The mean temperature, 34.3°, was about normal. The highest temperature, 86°, was recorded at Glenwood on the 4th, and the lowest, 12° below zero, at Williams on the 26th. The average precipitation was 1.51, or 0.25 less than normal. The greatest amount was 3.01 at Moorar, and the least, 0.45, at What Cheer. The month was generally favorable for farm work.

*Kansas.*—The mean temperature was 40.9°, or but 0.2° above the normal. The highest temperature, 82°, was recorded at Frankfort on the 4th, and the lowest, 2° below zero, at Coolidge, Ionia, and Jaqua on the 26th. The average precipitation was 1.43, or 0.48 in excess of the normal. The greatest amount, 4.19, occurred at Columbus, and the least, 0.20, at Grainfield. The average snowfall for the State was 1.5, the largest amount, 10.0, occurring at Oberlin, and the least, "trace," at several stations. Frosts occurred on every day except the 3d, 5th, 6th, 13th, and 28th.

*Kentucky.*—The month was slightly cooler than usual. The mean tem-